NORTEL

About Layer 2-3 switching

Fast, efficient, low-cost switching and routing of millions of packets per second-offering exponential advantages in throughput and cost-per-port compared to traditional routers.

Because today's Layer 2-3 devices don't have to read very deeply into the header (they don't care about the content of the payload or the application being used, for instance), they can operate very efficiently at very low cost-while providing exponentially greater throughput than traditional legacy routers.

- Understanding OSI and TCP/IP protocol layers
- Prevailing Layer 2-3 technologies

Understanding OSI and TCP/IP protocol layers

The Open Systems Interconnect (OSI) reference model outlines seven network layers-an overall framework in which communication protocols are organized-describing all elements of the communication, from how traffic traverses the physical medium (copper, fiber, etc.) at Layer 1, up to session and application characteristics at Layers 6 and 7.

Layer 2 of this OSI model, the "data link" layer, defines how packets get on and off the physical medium, how routing is performed between network devices, and how error detection, correction, and retransmission is performed. Layer 2 communication protocols contain the physical address inspected by a bridge or switch.

Typical Layer 2 technologies include frame relay, Token Ring, Fiber Distributed Data Interface (FDDI), ATM (asynchronous transfer mode), and Ethernet. Basic Layer 2 processing is faster than Layer 3 processing, because less analysis of the packet is performed.

Layer 3 of the OSI model, the "network" layer, governs routing and flow control, making sure that packets sent from one device to another arrive in reasonable time. In contemporary interpretation of the OSI model, Layer 3 is the "Internet" layer and uses IP-based addressing, security, quality-of-service (QoS) mechanisms, and more.

Layer 3 communication protocols contain the logical address of a packet's destination (usually IP address), which is inspected by a router or switch router. In the TCP/IP structure, Layer 3 contains a "type" field, so traffic can be prioritized and forwarded based on type of payload [low-priority email

and http or high-priority Voice over IP (VoIP), for example].

Because Layer 3 processing investigates the packet header more deeply, it adds more overhead than straight Layer 2 processing-but Layer 3 also introduces some creative workarounds. For one, Layer 3 devices can support "cut-through" routing, where the first packet of a stream is inspected at Layer 3, and the follow-on packets get express treatment at Layer 2. Devices known as Layer 3 "routing switches" or "switch routers" use special hardware instead of software to perform processing-intensive routing functions, enabling them to do packet-by-packet inspection at such high speeds that cut-through techniques aren't necessary.

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Prevailing Layer 2-3 technologies

In today's enterprise networks, Layer 2 switching provides the dedicated bandwidth and network segmentation critical for directly connecting users to the network. Layer 3 provides for switching and routing, maximizing speed, bandwidth, and flexibility in the network core or aggregation point.

At Layer 2, Ethernet won out against competing LAN technologies-such as ATM, token ring, and FDDI-because it is simple to implement and is extremely cost-effective. Ethernet-based technologies account for a vast majority of the world's network connection shipments, particularly in campus LANs and intranets.

The continuing evolution of Ethernet (IEEE 802.3) standards has resulted in significant improvements in the last decade, namely:

- In Ethernet's reach, via metro dark fiber and 10GigE SONET compatibility
- In Ethernet's reliability, via a new MAC Layer called Resilient Packet Rings, through new technologies such as split-Multilink Trunking (MLT), and carrier-grade Ethernet switching
- In Ethernet's security, via private labeling, including IEEE802.1Q VLANs
- In Ethernet's scalability, via 10 Gbps Ethernet and optically-enabled multi-Gbps switching

With the emergence of Optical Ethernet, the proven enterprise LAN technology emerged as the reliable, cost-effective, and speedy workhorse for MANs and WANs as well. Optical Ethernet now offers the reach, carrier-grade reliability, frame relay-level customer segmentation, and scalability to meet both enterprise and service provider requirements.

At Layer 3, it's no secret that Internet Protocol (IP) is completely transforming enterprise and service provider networks. Layer 3 devices make forwarding decisions based on IP address, type of traffic, quality-of-service requirements, and more.

Multi-layer switching combines Layer 2 MAC-address switching with Layer 3 protocol routing in one device. High-density application-specific integrated circuits (ASICs) support wire-speed switching and forwarding at far lower cost than traditional software-based legacy routers. Nortel Networks offers a broad portfolio of Ethernet switching products designed to deliver Layer 2-3 connectivity and packet switching-and for some platforms, also with Layer 4-7 IP "content-aware" intelligence.

Combining Layer 2-7 switching capabilities into one portfolio reduces global network load and costs, improves server and network response time, and enables differentiated services that cannot be achieved any other way.

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